

IN THE CLAIMS:

Please AMEND claims 11, 18, 27 and 28, and ADD claims 43-46 as follows. For the Examiner's convenience, all claims currently pending in this application have been reproduced below:

1 - 10. (Previously Cancelled)

11. (Currently Amended) An optical system for use in a projection exposure apparatus, said A projection optical system comprising:
a plurality of lenses that cause birefringence; and
at least one optical element for substantially eliminating the birefringence caused by said plurality of lenses, wherein said at least one optical element is disposed between said plurality of lenses and an image plane of said projection optical system.

12. (Previously Amended) An optical system according to claim 11, wherein said at least one optical element has form birefringence.

13. (Previously Cancelled)

14. (Previously Amended) An optical system according to claim 12, wherein said at least one optical element produces the form birefringence by a grating having a period smaller than a wavelength used.

15. (Previously Amended) An optical system according to claim 14, wherein said grating is provided on the surface of at least one of said lenses.

16. (Previously Amended) An optical system according to claim 11, wherein said at least one optical element has a stress distribution.

17. (Previously Cancelled)

18. (Currently Amended) A projection exposure apparatus comprising:
an illumination system for illuminating a reticle with light; and
a projection optical system for projecting a pattern of the reticle onto a wafer, said projection optical system including a plurality of lenses that cause birefringence, and at least one optical element for substantially eliminating the birefringence caused by said plurality of lenses,
wherein said at least one optical element is disposed between said plurality of lenses and an image plane of said projection optical system.

19. (Original) A projection exposure apparatus according to claim 18, wherein said illumination system illuminates the reticle with slit-like light, and further comprising a scanning device for simultaneously scanning the reticle and the wafer in a widthwise direction of the slit-like light, at a speed ratio corresponding to a projection magnification of said projection optical system.

20. (Previously Amended) A projection exposure apparatus according to claim 18, wherein said at least one optical element has form birefringence.

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21. (Previously Cancelled)

22. (Previously Amended) A projection exposure apparatus according to claim 20, wherein said at least one optical element produces the form birefringence by a grating having a period smaller than a wavelength used.

23. (Previously Cancelled)

24. (Previously Amended) A projection exposure apparatus according to claim 18, wherein said at least one optical element has a stress distribution.

25. (Previously Amended) A projection exposure apparatus according to claim 24, wherein said at least one optical member is arranged so that a distribution, including a distribution of stresses produced by said at least one optical member, is effective to cancel the birefringence of said plurality of lenses.

26. (Previously Amended) A device manufacturing method comprising the steps of:
exposing a wafer to a device pattern by use of a projection exposure apparatus as recited in claim 18; and
developing the exposed wafer.

27. (Currently Amended) An optical system for use in a step-and-scan type projection exposure apparatus, ~~said A projection~~ optical system comprising:
a plurality of ~~optical elements each causing birefringence~~, ~~said plurality of optical elements being arranged so that the birefringence of the optical system as a whole is substantially eliminated~~ lenses that cause birefringence; and
at least one optical element for substantially eliminating the birefringence caused by said plurality of lenses, wherein said at least one optical element is disposed near a pupil of said projection optical system.

28. (Amended) A step-and-scan type projection exposure apparatus comprising:
an illumination system for illuminating a reticle with light; and

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a projection optical system for projecting a pattern of the reticle onto a wafer, said projection optical system having a plurality of optical elements each causing birefringence, and said plurality of optical elements being arranged so that the birefringence of the optical system as a whole is substantially eliminated lenses that cause birefringence, and at least one optical element for substantially eliminating the birefringence caused by said plurality of lenses, wherein said at least one optical element is disposed near a pupil of said projection optical system.

29. (Previously Amended) A device manufacturing method, comprising the steps of:

exposing a wafer to a device pattern by use of a projection exposure apparatus as recited in claim 28; and
developing the exposed wafer.

30. (Previously Added) An optical system according to Claim 27, wherein said optical elements comprise a plurality of lenses each having birefringence and at least one element having form birefringence.

31. (Previously Added) An optical system according to Claim 27, wherein said optical elements comprise a plurality of lenses each having birefringence and at least one element having a stress distribution.

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32. (Previously Added) A projection exposure apparatus according to Claim 28, wherein said optical elements comprise a plurality of lenses each having birefringence and at least one element having form birefringence.

33. (Previously Added) A projection exposure apparatus according to Claim 28, wherein said optical elements comprise a plurality of lenses each having birefringence and at least one element having a stress distribution.

34. (Previously Added) An optical system according to claim 12, wherein the amount of birefringence of said at least one optical element is substantially the same as the amount of birefringence of said plurality of lenses as a whole, and wherein the sign of birefringence of said at least one optical element is opposite to the sign of said plurality of lenses as a whole.

35. (Previously Added) An apparatus according to claim 20, wherein the amount of birefringence of said at least one optical element is substantially the same as the amount of birefringence of said plurality of lenses as a whole, and wherein the sign of birefringence of said at least one optical element is opposite to the sign of said plurality of lenses as a whole.

36. (Previously Added) An optical system according to claim 30, wherein the amount of birefringence of said at least one optical element is substantially the same as the amount of

birefringence of said plurality of lenses as a whole, and wherein the sign of birefringence of said at least one optical element is opposite to the sign of said plurality of lenses as a whole.

37. (Previously Added) An apparatus according to claim 32, wherein the amount of birefringence of said at least one optical element is substantially the same as the amount of birefringence of said plurality of lenses as a whole, and wherein the sign of birefringence of said at least one optical element is opposite to the sign of said plurality of lenses as a whole.

38. (Previously Added) An optical system according to claim 30, wherein said at least one optical element produces the form birefringence by a grating having a period smaller than a wavelength used.

39. (Previously Added) A projection exposure apparatus according to claim 32, wherein said at least one optical element produces the form birefringence by a grating having a period smaller than a wavelength used.

40. (Previously Added) A device manufacturing method, comprising the steps of:
exposing a wafer with a device pattern by use of a projection exposure apparatus as recited in claim 32; and
developing the exposed wafer.

cont'd

41. (Previously Added) A device manufacturing method, comprising the steps of:
exposing a wafer with a device pattern by use of a projection exposure apparatus
as recited in claim 33; and
developing the exposed wafer.

42. (Previously Added) A device manufacturing method, comprising the steps of:
exposing a wafer with a device pattern by use of a projection exposure apparatus
as recited in claim 35; and
developing the exposed wafer.

43. (New) An optical system according to Claim 11, wherein said at least one optical element comprises a transparent plane plate.

44. (New) A projection exposure apparatus according to Claim 18, wherein said at least one optical element comprises a transparent plane plate.

45. (New) An optical system according to Claim 27, wherein said at least one optical element comprises a transparent plane plate.

46. (New) A step-and-scan projection exposure apparatus according to Claim 28,
wherein said at least one optical element comprises a transparent plane plate.